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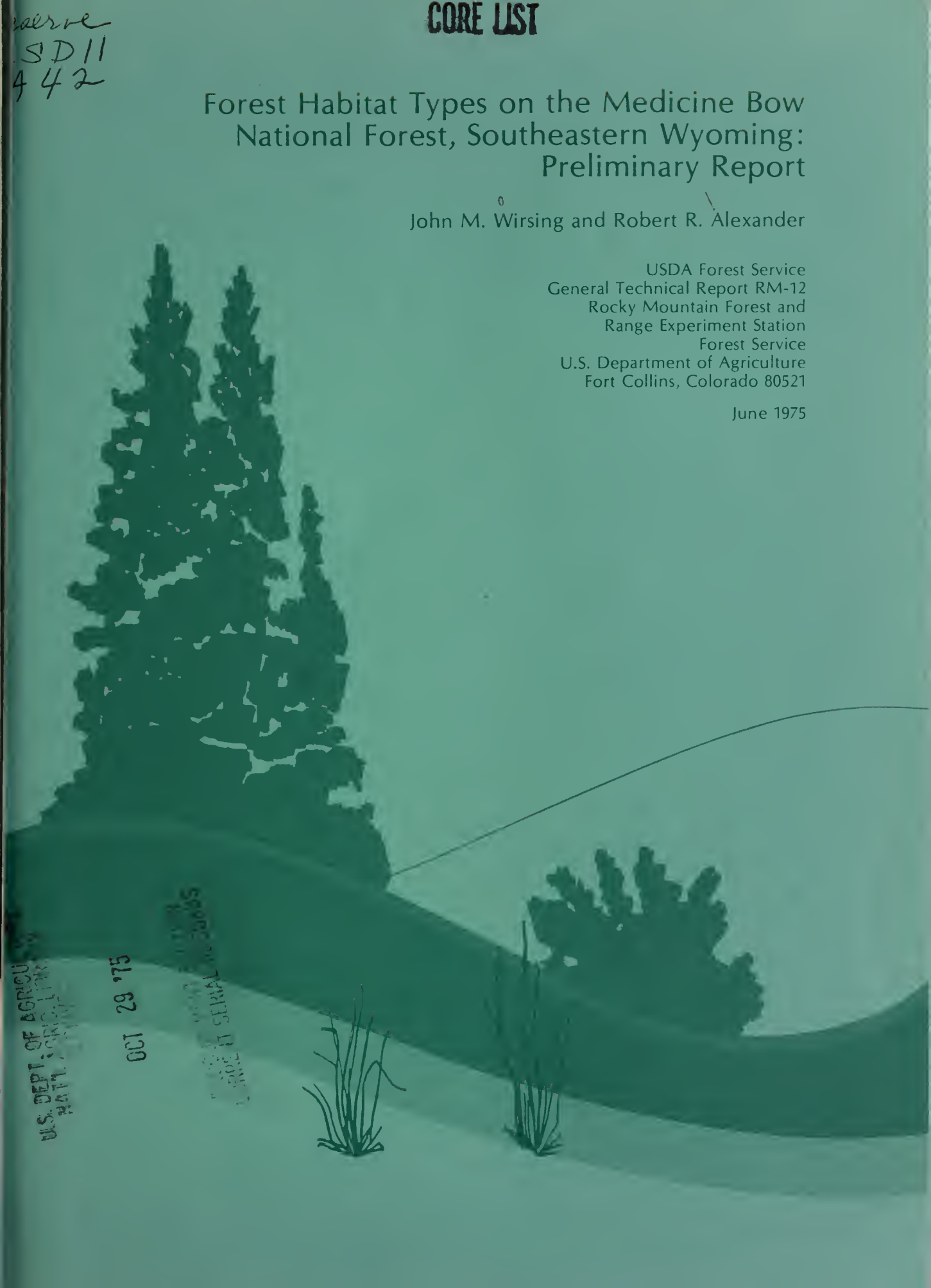
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Forest Habitat Types on the Medicine Bow
National Forest, Southeastern Wyoming:
Preliminary Report

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USDA Forest Service
General Technical Report RM-12
Rocky Mountain Forest and
Range Experiment Station
Forest Service
U.S. Department of Agriculture
Fort Collins, Colorado 80521

June 1975



U.S. DEPT. OF AGRICULTURE
FOREST SERVICE
HATT, COLORADO

OCT 29 '75

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OCT 29 1975

Abstract

Wirsing, John M., and Robert R. Alexander.

1975. Forest Habitat types on the Medicine Bow National Forest, southeastern Wyoming: Preliminary report. USDA For. Serv. Gen. Tech. Rep. RM-12, 11 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo. 80521

A vegetation classification based on concepts and methods developed by Daubenmire was used to identify five habitat types and their related phases on the Medicine Bow National Forest: *Abies lasiocarpa*/*Vaccinium scoparium*, including the *Pinus contorta*/*Vaccinium scoparium* community; *Abies lasiocarpa*/*Carex geyeri*, including the *Pinus contorta*/*Carex geyeri* community; *Populus tremuloides*/*Carex geyeri*; *Pinus ponderosa*/*Carex geyeri*; and *Pinus flexilis*/*Carex geyeri*. A key to identify the habitat types and management implications associated with them are provided.

Keywords: Vegetation classification, *Abies lasiocarpa*, *Picea engelmannii*, *Pinus contorta*, *Pinus ponderosa*, *Pinus flexilis*, *Populus tremuloides*.

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**Forest Habitat Types on the Medicine Bow
National Forest, Southeastern Wyoming:
Preliminary Report** C D //

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Forest Habitat Types on the Medicine Bow National Forest, Southeastern Wyoming: Preliminary Report

John M. Wirsing and Robert R. Alexander

The forest vegetation of the central Rocky Mountains is a diverse mixture of communities, each of which reproduces, grows, and reacts differently in response to ecological and biological conditions. Until recently, however, little effort has been made to classify these forests into units of similar vegetation or like biological potential. In 1970, a cooperative study was started between Washington State University and the Rocky Mountain Forest and Range Experiment Station to (1) classify forest vegetation on the Medicine Bow National Forest in Wyoming into habitat types, and (2) develop a key that would be helpful in identifying these types. The classification, completed in 1972 (Wirsing 1973), was based on concepts and methods developed by Daubenmire (1952) and extended and modified by Daubenmire and Daubenmire (1968), Reed (1969), Pfister (1972), and Pfister and others (1972, 1973a, 1973b).

STUDY AREA

DESCRIPTION

The Medicine Bow National Forest is located within the mountainous areas of Carbon, Converse, and Albany counties in southeastern Wyoming. This Forest, totaling more than 1.4 million acres, is composed of four administrative units separated by extensive basins and low, broad valleys (fig. 1). Table 1 shows the size, elevation, and principal vegetation of each unit.

The **Snowy Range unit**, located within the Medicine Bow Mountain Range about 30 to 35 miles west of Laramie, extends approximately 35 miles north of the Colorado-Wyoming border. Extensive Precambrian gneiss and igneous rock, underlies most of the unit (Thornbury 1965). It is bordered on the east by the Laramie Basin, which contains sedimentary rocks ranging in age from Paleozoic to Recent, and on the

west by the North Platte Valley, which contains principally sedimentary rocks of Tertiary Age. Glacial drift of Pleistocene time is abundant in the northern portion of the Snowy Range, where it originated from an ice cap near Medicine Bow Peak (Houston 1968). As a result, numerous streams and lakes are found in this area. In the southern portion, very little glacial action took place.

Across the North Platte Valley to the west lies the **Sierra Madre unit**, which extends for 40 miles along the Colorado-Wyoming border and 20 miles north of the State line. Rolling hills and less precipitous mountains than those found in the Snowy Range characterize this area. It is bordered on the north and east by bedrock of Tertiary sedimentary origin, while the west and southwest are rimmed by Tertiary igneous rock of volcanic origin. Precambrian bedrock also underlies most of this region (Thornbury 1965).

The **Pole Mountain unit**, an important recreation area, is located in the Laramie Mountain Range. It consists mainly of rolling hills with a few rugged mountainous areas. The Sherman Mountains, located in the southwest portion of the unit, are considered to be erosional remnants (Monadnocks) rising above the general level of the surface of the Laramie River. The underlying bedrock is Precambrian granite. The southern area of the unit is covered with peculiar rock formations caused by planes of weakness in the granite, dividing it into blocks, and capped with balanced rocks. In contrast, sedimentary bedrock of Paleozoic origin underlies the northwest section of the unit. High plains border this part of the National Forest on the east and west, with rolling hills to the north and south.

Located in the northernmost extension of the Laramie Mountains about 100 miles north of Laramie, the **Laramie Peaks unit** is bordered on the north and east by high plains and on the west by the Shirley Basin. To the south, it gradually extends into

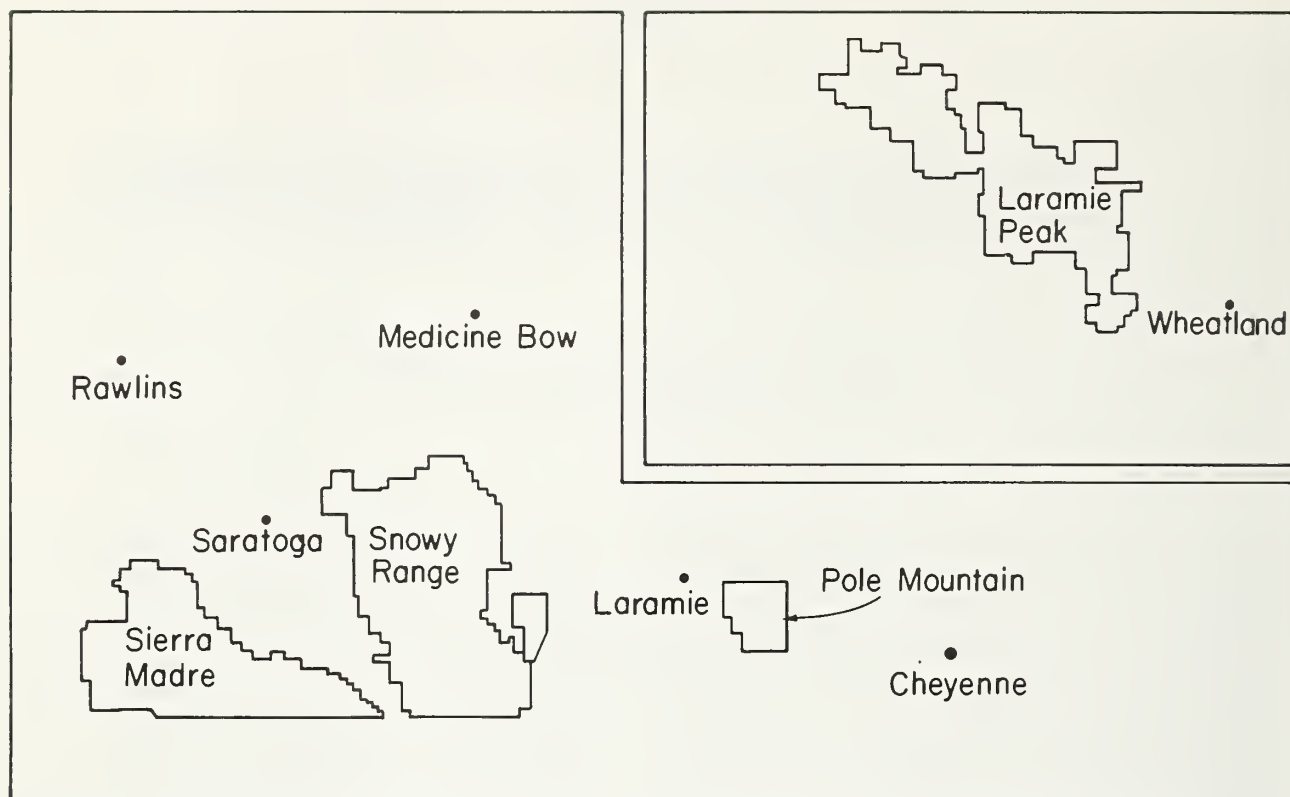


Figure 1.—Study areas on the four administrative units of the Medicine Bow National Forest, Wyoming.

Table 1.—Size, elevational range, and principal forest vegetation in the four administrative units, Medicine Bow National Forest, Wyoming

Unit	Area	Elevation	Principal forest vegetation
	<i>Acres</i>	<i>Feet</i>	
Snowy Range	600,000	8,000 to 12,013 (2,438 m) (3,662 m)	<i>Abies lasiocarpa</i> , <i>Picea engelmannii</i> , <i>Pinus contorta</i> .
Sierra Madre	330,000	6,500 to 11,044 (1,981 m) (3,354 m)	<i>Abies lasiocarpa</i> , <i>Picea engelmannii</i> , <i>Pinus contorta</i> , <i>Populus tremuloides</i> .
Pole Mountain	56,000	8,200 to 9,053 (2,499 m) (2,759 m)	<i>Pinus ponderosa</i> , <i>Pinus flexilis</i> .
Laramie Peaks	¹ 440,000	6,300 to 10,272 (1,920 m) (3,131 m)	<i>Pinus ponderosa</i> .

¹ 177,000 acres are National Forest land.

the Pole Mountain unit. The topography can be characterized as very rugged, with most of the region containing bedrock of Precambrian origin (Thornbury 1965). This unit is an important water, grazing, and recreation area for surrounding ranches and communities.

While the number of species of arboreal trees is limited on the Medicine Bow National Forest, the understory has a large variety of shrubs, graminoids, and forbs (Wirsing 1973).

CLIMATE

The precipitation pattern on the Medicine Bow National Forest is closely tied to elevation. Mean annual precipitation varies from about 15 inches (38.10 cm) at 6,000 ft (1,829 m) elevation to 25 inches (63.50 cm) or more at 10,000 ft (3,049 m) elevation. At lower elevations, about three-fourths of the precipitation falls mostly as rain during the period April through September, while at elevations above 8,000 ft (2,438 m), about two-thirds of the annual precipitation falls as snow during the period October through May.

Mean annual temperature in the *Pinus ponderosa* forest zone is about 45°F (7.2°C), with a maximum range of -40°F (-40°C) to 110°F (43.3°C). In the *Picea engelmannii*-*Abies lasiocarpa* forest zone, mean annual temperature is less than 35°F (1.7°C), and frost can occur any month of the year. Temperature varies from -50°F (-45.6°C) to about 90°F (32.2°C).

METHODS

FIELD SAMPLING

Preliminary work in the Medicine Bow National Forest was begun in the summer of 1970. A total of 221 reconnaissance plots were located to sample the various tree species present over a wide geographic area. For each plot, such environmental factors as location, elevation, direction and percent slope, as well as a representative list of the trees, shrubs, forbs, grasses, and sedges present in each, were recorded. All stands were selected on the basis of similarity of vegetation, relief, soil conditions, and age since the last burn. Ecotones and areas influenced by grazing were avoided.

During the summers of 1971 and 1972, fieldwork was conducted on 120 locations selected for intensive sampling. These stands were chosen from the reconnaissance plots as representative of the forest communities characterized by the following tree species: *Picea engelmannii*, *Abies lasiocarpa*, *Pinus*

flexilis, *Pinus ponderosa*, *Pinus contorta*, and *Populus tremuloides*.

In each stand, plots 15 by 25 m were located where environment, overstory, and understory were similar. Each plot was selected to represent either a climatic or topographic climax or seral successional stage. Each 375 m² plot was then subdivided into three 5 by 25 m macroplots. Next, 20- by 50-cm microplots were located along the sides of the central macroplot at 1-m intervals to obtain 50 ground canopy coverage measurements.

All trees within each 375 m² plot above 1 dm in diameter, measured at breast height, were recorded in eight diameter classes; tree seedlings less than 1 dm were recorded in three additional classes. In the microplots, canopy coverage was recorded independently for each species of shrubs, graminoid, and forb as one of six coverage classes (0-5, 5-25, 25-50, 50-75, 75-95, and 95-100 percent). In addition, a second list included other species present within the 375 m² plot. A third list consisted of additional species outside the 375 m² plot.

The serotinous cone habit of *Pinus contorta* in the Rocky Mountains is an important factor in regeneration success (Lotan 1967, 1968). To determine whether a plot contained serotinous or nonserotinous cones, crowns of 10 trees within the 375 m² area were observed with field glasses. The type of cone behavior observed over 90 percent of the tree was then indicated on the data sheet.

ANALYSIS OF DATA

For each microplot examined, the midpoints of the coverage classes were used to calculate average percent coverage for each shrub, graminoid, and forb present. Species coverages and selected stand characteristics were then transferred to an association table. Stands were arranged and rearranged to group stands with similar floristic composition. The first major separation was based on the tree species composition and climax tree species. Habitat type separation was based on major shrubs, graminoids, and forbs. Finally, distinctive minor floristic differences were used to differentiate phases. (For further details on the method of analysis see Daubenmire 1952 and Daubenmire and Daubenmire 1968.)

TAXONOMIC CONSIDERATIONS

A majority of the forbs and shrubs were identified in the field. The forbs and graminoids that could not be positively identified as to species were sent to the U.S. Forest Service Herbarium, Fort Collins, Colorado, for verification. Nomenclature for the plant species collected is that of Weber (1967).

RESULTS

The following five habitat types and related phases were recognized:

1. *Abies lasiocarpa/Vaccinium scoparium* habitat type, which includes the *Pinus contorta/Vaccinium scoparium* community.
 - a. *Sibbaldia-Bistorta* phase
2. *Abies lasiocarpa/Carex geyeri* habitat type, which includes the *Pinus contorta/Carex geyeri* community.
3. *Populus tremuloides/Carex geyeri* habitat type.
4. *Pinus ponderosa/Carex geyeri* habitat type.
 - a. *Lupinus argenteus* phase
 - b. *Sedum lanceolatum* phase
5. *Pinus flexilis/Hesperochloa kingii* habitat type.
 - a. *Pulsatilla ludoviciana* phase
 - b. *Koeleria cristata* phase

HABITAT TYPE:

ABIES LASIOCARPA/VACCINIUM SCOPARIUM

Description

The *Abies lasiocarpa/Vaccinium scoparium* habitat type, represented by 57 plots at elevations ranging from 7,710 ft (2,350 m) to 10,600 ft (3,321 m), was the most widespread habitat type found (fig. 2). It is recognized not only by the almost constant presence and reproductive success of *Abies lasiocarpa*, but also by the abundance and understory dominance of the low shrub *Vaccinium scoparium*. *Picea engelmannii* is frequently or occasionally present as a co-climax species, with reproduction generally from fair to poor. This habitat type is bordered at its upper limits by timberline and at its lower limits by the *Populus tremuloides/Carex geyeri* habitat type.

In the 34 stands above 8,580 ft (2,615 m), composition of the overstory is most often *Abies* and *Picea*, but occasionally stands may be dominated by either species. The only major seral species generally



Figure 2.—*Abies lasiocarpa/Vaccinium scoparium* habitat type.

present in these old stands is *Pinus contorta*. These trees are usually large in diameter and have low reproductive success. *Pinus contorta* may occur mixed with the climax species in the overstory, or stands may be *Pinus contorta* with advanced *Abies lasiocarpa* reproduction. These latter stands are similar to the widespread seral *Pinus contorta/Vaccinium scoparium* community found at lower elevations and on south and west slopes as high as 8,800 ft (2,927 m) except that they do not cover extensive areas. *Pinus flexilis* is considered only a minor seral component in these stands. A very distinctive feature of these stands is the almost complete absence of *Populus tremuloides* as a seral species.

The understory is not so simple, with species diversity ranging from a low of five species to a maximum of 50. *Vaccinium scoparium* is the dominant shrub, with occasional *Vaccinium myrtillus*, *Rosa woodsii*, *Vaccinium caespitosum*, *Pyrola secunda*, and *Juniperus communis*. *Carex rossii*, *Trisetum spicatum*, and *Poa reflexa* are the most abundant graminoids, but *Carex geyeri* and *Poa nervosa* tend to be dominant wherever they occur. Understory forbs present most frequently in this habitat type are *Arnica cordifolia*, *Epilobium angustifolium*, *Erigeron peregrinus*, *Erythronium grandiflorum*, *Hieracium gracile*, *Thlaspi alpestre*, *Pedicularis racemosa*, and *Pedicularis bracteosa*.

Although stands in this habitat type appear only sporadically in the Laramie Peaks and Pole Mountain units, dense stands covering a wide area are found both in the Sierra Madre and Snowy Range units. Apparently this association thrives best in the colder, higher, and more humid climates on deep, well-drained loam soils on glacial outwash and alluvial plains. Parent material underlying this association, in both the Snowy Range and Sierra Madre units, consists of sandstone, shale, siltstone, interbedded conglomerate, glacial outwash, loess, mafic igneous rock, gneiss, and quartzite.

Fire is believed to be the major disturbance, as evidence of fire was recorded in a majority of the stands studied. Insect infestation is considered slight, since only two stands were affected. Snowmold damage is also minor, occurring only in subalpine stands over 10,000 ft (3,408 m). Broomrust often appears on *Abies lasiocarpa* in this habitat type. More of those stands infected by this disease are in the subalpine region east of the Continental Divide.

Pinus contorta/Vaccinium scoparium Community

The remaining stands sampled in this habitat type belong to the seral *Pinus contorta/Vaccinium scoparium* community. This community of fire origin is widespread on the Medicine Bow National Forest at

elevations ranging from 7,710 ft (2,350 m) to 9,800 ft (2,987 m). It is recognized by the dense overstory of mature or immature *Pinus contorta* and a successfully reproducing seedling understory of *Abies lasiocarpa*. *Pinus contorta* probably reproduces poorly because a closed canopy cover results in light, temperature, and moisture conditions inadequate for the survival of seedlings. Other minor components or accidental species in the overstory of this association may be *Populus tremuloides*, *Pinus flexilis*, *Pinus ponderosa*, and *Pseudotsuga menziesii*, depending upon the seed source available.

The understory of these stands is quite similar and almost as varied as the vegetation found in stands dominated by *Abies-Picea*, with species diversity ranging from a low of six species to a high of 34. *Vaccinium scoparium* is the dominant shrub, but coverage values are frequently lower than in stands dominated by *Abies-Picea*. *Vaccinium myrtillus*, *Juniperus communis*, *Berberis repens*, *Pyrola secunda*, *Rosa woodsii*, and *Shepherdia canadensis* are the other most abundant shrub components. Of the many graminoids present within the community, *Carex rossii*, *Poa nervosa*, and *Trisetum spicatum* show the highest constancy. *Carex geyeri* is present in many of the plots examined whether these are dominated by *Vaccinium scoparium* or not, although the coverage value increases significantly as *Vaccinium scoparium* coverage decreases.

The most extensive mature stands of *Pinus contorta* are present in the Snowy Range and Sierra Madre units; fewer and more immature stands are located in the Pole Mountain and Laramie Peaks units. The association occurs over a wide range of soils, but seems to thrive best on moderately acid sands or gravelly loams.

Data collected on the fruiting habit of *Pinus contorta* indicate that nonserotiny is more prevalent in plots above 9,100 ft (2,774 m) elevation, while serotiny occurs with more frequency at lower elevations. These findings are in agreement with the results obtained by Lotan (1963).

Arceuthobium americanum often reduces growth in mature stands of *Pinus contorta* and kills new reproduction. It was observed on only seven of the study plots, however.

Sibbaldia-Bistorta Phase

This weakly defined phase, found at elevations above 8,580 ft (2,615 m), is distinguished only by the presence of *Bistorta bistortoides*, *Sibbaldia procumbens*, *Draba crassifolia*, *Potentilla diversifolia*, *Ranunculus eschscholtzii*, and *Senecio dimorphophyllus*.

Management Implications

Understory vegetation changes slowly after major disturbance. Competition between tree seedlings and understory vegetation is not severe. In stands dominated by *Abies* and *Picea* there is frequently a manageable stand of advanced reproduction. Timber productivity is average. Clearcutting in small patches (5 acres or less) or narrow (400-ft wide) strips, and shelterwood and group selection cutting may be used on north and east slopes where natural reproduction is desired. Shelterwood and group selection cutting should be used on south and west slopes unless artificial regeneration is planned. Seedbed preparation will be needed where the L, F, or H layers exceed 2 inches in depth. In stands dominated by *Pinus contorta*, timber productivity is average to above average. Small patch or strip clearcuts should be used where pine reproduction is desired in stands with *Abies* and *Picea* advanced reproduction or in pure *Pinus contorta* stands where the cone habitat is nonserotinous. Shelterwood cutting is an additional alternative, but it may be difficult to regenerate *Pinus contorta* unless stands are pure *Pinus contorta*. In stands dominated by *Pinus contorta* where pine reproduction is desired, larger clearcut openings (up to 40 acres) may be used if the cone habitat is serotinous. Large clearcut openings in nonserotinous

stands will require artificial regeneration. This habitat type is big-game summer range and occupies elevations where snowfall is heavy. Small patch or strip clearcuts result in greater production of forage for big-game and larger increases in water available for streamflow than either shelterwood or group selection cutting.

HABITAT TYPE:

ABIES LASIOCARPA/CAREX GEYERI

Description

The *Abies lasiocarpa*/*Carex geyeri* habitat type is prevalent throughout the Medicine Bow National Forest. The overstory is composed of the same tree species as found in the *Abies*/*Vaccinium scoparium* habitat type. Understory components are also similar to the *Abies*/*Vaccinium scoparium* habitat type, with the exception that *Carex geyeri* is dominant over *Vaccinium scoparium* if the *Vaccinium* is represented at all.

This habitat type is represented by five plots dominated by an *Abies*-*Picea* overstory and by 10 plots in a seral *Pinus contorta*/*Carex geyeri* community (fig. 3). This habitat type is usually found at lower elevations (mean elevation of $8,730 \pm 59$ ft).



Figure 3.—*Pinus contorta*/*Carex geyeri* community (*Abies lasiocarpa*/*Carex geyeri* habitat type).

Management Implications

Understory vegetation in this habitat type recovers slowly from major disturbance. Reproduction in this drier habitat type is likely to be more difficult to obtain, and competition between tree seedlings and understory vegetation more severe than in the higher *Abies/Vaccinium* habitat type. In stands dominated by either *Abies-Picea* or *Pinus contorta*, timber productivity is average to below average. Cutting methods applicable are similar to those suggested for the *Abies/Vaccinium* habitat type. This habitat type provides forage for domestic livestock and big-game. Heavy grazing may reduce the *Carex* cover and expose soils difficult to revegetate.

HABITAT TYPE:

POPULUS TREMULOIDES/CAREX GEYERI

Description

The *Populus tremuloides/Carex geyeri* habitat type was observed in all four units of the Medicine Bow National Forest (fig. 4.). Usually, it appears in

small clonal patches scattered over the landscape at the lower fringes of the coniferous forest. On the western slope of the Sierra Madre unit, however, stands appear extensively on cooler and more moist sites where porous humic soils are found. A total of 19 plots, ranging in elevation from 7,750 ft (2,362 m) to 9,025 ft (2,751 m) and representing a wide variety of topographic aspects and degrees of slope, were examined. Bordering and frequently represented in this association as minor accidentals with low reproductive success are such tree species as *Picea engelmannii*, *Pinus contorta*, *Pinus flexilis*, and *Pinus ponderosa*. The majority of these stands are located west of the Continental Divide.

This association is quite distinctive from all other *Populus tremuloides* habitat types identified to date in the Rocky Mountains. It has *Carex geyeri* regularly present and important in the understory. It lacks *Symphoricarpos oreophilus*, which was so distinctive in the *Populus tremuloides* habitat types found in the Wind River Mountains in western Wyoming (Reed 1969). The understory is generally quite lush, with a shrub layer composed of *Juniperus communis*, *Rosa woodsii*, *Amelanchier alnifolia*, and *Berberis repens*. Other graminoids and forbs of high



Figure 4.—*Populus tremuloides/Carex geyeri* habitat type.

constancy found in the understory are *Elymus glaucus*, *Achillea lanulosa*, *Arnica cordifolia*, *Galium boreale*, and *Osmorhiza depauperta*.

Carex geyeri has a high constancy value (89 percent) but a low average canopy coverage (25 percent). *Arnica cordifolia* is widely distributed, with a high constancy value and a low canopy coverage value, but much lower than that attained by *Carex geyeri*. In addition, species diversity of the understory vegetation covers a wide range from a low of 20 to a high of 47 species.

Although only seven out of the 19 plots examined had any visible evidence of fire, the role of fire in the maintenance of this habitat type is not fully understood. Most of the study plots appeared to have been grazed, but reproduction was prolific in the majority of plots examined. Parent material of this habitat type, in both the Snowy Range and Sierra Madre units, consists of sedimentary rock, glacial outwash, loess, shale, gneiss, mafic igneous rock, terrace deposits of alluvium, and limestone.

Management Implications

Relatively little information is available on the management of this habitat type. Timber productivity is average to above average. *Populus tremuloides* can be maintained by clearcutting in small patches or strips. This habitat type is grazed by big-game and livestock. Heavy grazing may reduce *Carex* cover and expose soils that are difficult to revegetate. This habitat type is also valuable for the fall color it provides.

HABITAT TYPE:

PINUS PONDEROSA/CAREX GEYERI

Description

This climax association is characterized by a lush understory beneath a pure or almost pure cover of *Pinus ponderosa*. Shrubs frequently present in the undergrowth are *Arctostaphylos uva-ursi*, *Juniperus communis*, *Berberis repens*, and *Sedum lanceolatum*. The graminoids are well represented by *Carex geyeri* and *Hesperochloa kingii*. The most frequently encountered forbs are *Arnica cordifolia*, *Campanula rotundifolia*, *Cirsium canescens*, *Crepis acuminata*, and *Potentilla frissa*. Species diversity within the understory covers a wide range, from a low of 19 species to a very high total of 52.

Extensive stands of *Pinus ponderosa* are restricted to the Laramie Peaks unit, while only a few dwindling relics remain in the Snowy Range unit. A few immature stands are also found within the Pole Mountain unit, but no *Pinus ponderosa* was observed

in the Sierra Madre unit. This association occurs on well-drained, deep, sandy, graveled, or clay-loam soils. Thirteen plots, ranging in elevation from 6,150 ft (1,875 m) to 8,480 ft (2,585 m), and on varying topographic aspects, were studied. Such tree species as *Pinus contorta*, *Pinus flexilis*, and *Populus tremuloides* are occasionally represented, but are minor accidentals. The majority of the stands are located east of the Continental Divide.

The *Pinus ponderosa*/*Carex geyeri* habitat type occurs under a variety of soil and climatic conditions, but it is confined to areas of relatively low rainfall. Reproduction, which was low in most of the plots, seemed to follow an episodic cycle. This cycle may be caused by vagaries in weather that influence seed set and seedling mortality, or by the influence of fire which destroys seedlings in certain years. With the decrease in the occurrence of fire due to the present fire prevention policy, both the forbs and graminoids found in these plots may provide competition that is too formidable for the seedlings to survive. Evidence of fire was found in seven of the 13 plots studied. Damage from dwarf mistletoe was not observed in any of the areas, and only one stand had an insect infestation.

Lupinus argenteus Phase

The most critical indicator plant of this phase is *Lupinus argenteus*. Other significant species characteristic of the seven plots of this unit are *Berberis repens*, *Cirsium canescens*, and *Apocynum androsaemifolium*. *Arctostaphylos uva-ursi* is the least critical indicator, since its appearance and abundance over the landscape is erratic. This phase can be recognized in the Laramie Peaks unit as well as in the relic stands present within the Snowy Range unit.

Sedum lanceolatum Phase

Sedum lanceolatum is the major indicator plant in the six plots representing this phase. It is further identified by the complete absence of *Lupinus argenteus*, *Berberis repens*, and *Cirsium canescens*. It can be observed not only in the Laramie Peaks unit, but to a limited extent in the Pole Mountain and Snowy Range units.

Management Implications

This habitat type is valuable for forage production and recreational use; timber productivity is low. Heavy grazing by either big-game animals or domestic livestock may be destructive to the *Carex* cover. On areas harvested for timber, shelterwood, group

selection, and individual-tree selection cutting may be used. Stand density should be kept low to minimize damage from mountain pine beetle. Reproduction is likely to be difficult to obtain in years of low rainfall. Seedbed preparation will be needed to reduce competition, but care must be taken not to destroy the *Carex* cover.

HABITAT TYPE:

PINUS FLEXILIS/HESPEROCHLOA KINGII

Description

The *Pinus flexilis/Hesperochloa kingii* habitat type is distinguished from all other habitat types by the consistent presence of *Hesperochloa kingii* in the understory of *Pinus flexilis* stands. *Pinus contorta*, *Abies lasiocarpa*, and *Populus tremuloides* occur as minor accidentals.

The understory vegetation of this habitat type is usually sparse and low. *Artemisia tridentata*, *Juniperus communis*, and *Ribes cereum* are the most frequent shrubs, but their coverage value is quite low. The most consistent grasses are *Hesperochloa kingii*, *Agropyron spicatum*, *Koeleria cristata*, and *Poa cusickii*, while the forbs are usually *Antennaria rosea*, *Arenaria congesta*, *Erigeron flagellaris*, *Sedum lanceolatum*, and *Potentilla fissa*. Species diversity varies considerably from stand to stand, with a recorded low of 25 species to a high of 42.

Open stands of the *Pinus flexilis/Hesperochloa kingii* habitat type are found in all four units of the Medicine Bow National Forest, but the most extensive stands are located in the Pole Mountain unit. It is a topographic climax within the *Picea engelmannii-Abies lasiocarpa* zone, and is representative of dry, stony soils of ridgetops, especially with southwesterly windswept exposures. Ten plots, ranging in elevation from 8,425 ft (2,568 m) to 9,790 ft (2,984 m) were observed. These small, widely distributed stands are usually bordered by *Pinus contorta* and *Abies lasiocarpa*. All permanent plots were located east of the Continental Divide.

Due to the harshness of the microclimatic conditions of this habitat, reproduction is sporadic and slow. Most of the seed production may be destroyed by small animals. The seeds not consumed usually germinate in clusters of four to seven, but only one, or possibly two, may survive to maturity. Fire, also a threat to reproductive success in this habitat type, occurred in five of the stands examined. *Arceuthobium* sp., in advanced stages, was observed in only one plot in the Pole Mountain unit. Isolated stands of *Pinus flexilis* known to exist in the southwestern portion of the Laramie Peaks unit, were not studied.

Pulsatilla ludoviciana Phase

The stands that represent this phase are found mainly in the Sierra Madre and Snowy Range units and, to a limited extent, in the Pole Mountain unit. It is distinguished by the presence of the forbs *Pulsatilla ludoviciana* and *Phlox multiflora*, and by the frequent absence of grasses such as *Koeleria cristata* and *Poa cusickii*.

Koeleria cristata Phase

Indicators of this phase can be recognized frequently in the Pole Mountain and Sierra Madre units and occasionally in the Snowy Range unit. It is distinguished by the constant presence of *Koeleria cristata*, and the usual presence of *Poa cusickii* and the absence of *Pulsatilla ludoviciana* and *Phlox multiflora*.

Management Implications

This dry habitat type is of little interest or value for timber production. Its primary use is for forage by big-game and livestock.

OTHER VEGETATION COMMUNITIES

Several other minor plant communities present in the Medicine Bow National Forest were not included in this study. These minor components within a complex forest mosaic represent topographic, edaphic, or other special environmental conditions not characteristic in the major habitat types and phases. The following are additional plant communities observed during this study.

Juniperus scopulorum Community

Small patches of this hardy shrub are found in the southern portion of the Laramie Peaks unit. Also, the species was observed as a minor accidental in the *Pinus ponderosa/Carex geyeri* habitat type.

Pseudotsuga menziesii Community

Pseudotsuga menziesii is poorly represented in the forested areas studied. No communities dominated by this tree were observed in either the Laramie Peaks or Sierra Madre units. However, it does appear at low elevations on the western margins of the Snowy Range unit, (Hana 1934) and on shaded

slopes on the north side of Telephone Canyon between Laramie and Cheyenne. At the latter location, it was heavily logged in the past, probably during the construction of the Union Pacific Railroad. It is quite possible that these trees are remnants from previous extensive forests of this species. The vegetation classification map of the Medicine Bow National Forest (Douglas 1913) shows *Pseudotsuga* stands on the west side of the Snowy Range unit.

Quercus gambellii Community

Quercus gambellii, a small deciduous tree or shrub, is abundant in the dry foothills and canyon walls on the southwestern edge of the Sierra Madre unit. Generally, it is confined to the lower fringes of the Montane Zone below the *Abies-Picea* and *Pinus contorta* communities. This xerophytic community was not observed in any other area of the Medicine Bow National Forest.

Alnus tenuifolia Community

This shrub community was observed along the roadside and streambanks on the western slope of the Sierra Madre unit. Usually it is confined to pond borders and sites along mountain streams, but it may form more extensive stands in other areas. This species is associated with the distribution of the *Abies lasiocarpa/Vaccinium scoparium* habitat types.

KEY TO FOREST HABITAT TYPES

The following key to the major forest associations of southeastern Wyoming has been prepared to identify habitat types and phases present in relatively undisturbed stands.

1. *Pinus ponderosa* present and reproducing; other conifers absent
..... *PINUS PONDEROSA*/
CAREX GEYERI HABITAT TYPE (2)
2. *Lupinus argenteus*, *Berberis repens*, *Cirsium canescens*, *Apocynum androsaemifolium* usually present
..... *LUPINUS ARGENTEUS* PHASE
2. *Lupinus argenteus*, *Berberis repens*, *Cirsium canescens*, *Apocynum androsaemifolium* usually absent; *Sedum lanceolatum* usually present
..... *SEDUM LANCEOLATUM* PHASE

1. *Pinus ponderosa* absent, or other trees well represented (3)
3. *Populus tremuloides* is the sole tree reproducing well
..... *POPULUS TREMULOIDES*/
CAREX GEYERI HABITAT TYPE
3. *Populus tremuloides* absent, or at least poorly represented (4)
4. *Pinus flexilis* absent or poorly reproducing; *Abies lasiocarpa*, *Picea engelmannii*, or *Pinus contorta* well represented . (5)
5. *Vaccinium scoparium* dominant in the undergrowth; *Carex geyeri* a minor species, if at all present (6)
6. *Sibbaldia procumbens*, *Bistorta bistortoides*, *Draba crassifolia*, *Potentilla diversifolia*, *Ranunculus eschscholtzii*, and *Senecio dimorphophyllus* absent
..... *ABIES LASIOCARPA* / *VACCINIUM SCOPARIUM* HABITAT TYPE
6. *Sibbaldia procumbens*, *Bistorta bistortoides*, *Draba crassifolia*, *Potentilla diversifolia*, *Ranunculus eschscholtzii*, and *Senecio dimorphophyllus* present singly or collectively
..... *ABIES LASIOCARPA*/
VACCINIUM SCOPARIUM
HABITAT TYPE, *SIBBALDIA-BISTORTA* PHASE
5. *Carex geyeri* dominant in the undergrowth; *Vaccinium scoparium* absent *ABIES LASIOCARPA*/
CAREX GEYERI HABITAT TYPE
4. *Pinus flexilis* dominant and reproducing
..... *PINUS FLEXILIS*/*HEPER-OCHLOA KINGII* HABITAT TYPE (7)
7. *Phlox multiflora* and/or *Pulsatilla ludoviciana* usually present
..... *PULSATILLA LUDOVICIANA* PHASE
7. *Phlox multiflora* and *Pulsatilla ludoviciana* absent; *Koeleria cristata* and/or *Poa cusickii* usually present .
.. *KOELERIA CRISTATA* PHASE

The distribution and successional status of tree species in relation to habitat type are shown in figure 5.

Figure 5.—

Distribution of tree species
through the series of habitat types,
showing dynamic status :

C = major climax species

S = seral

(S) = seral in certain areas of the type

A = accidentals

Species Habitat Type							
	<i>Abies lasiocarpa</i>	<i>Picea engelmannii</i>	<i>Pinus ponderosa</i>	<i>Populus tremuloides</i>	<i>Pinus contorta</i>	<i>Pinus flexilis</i>	<i>Pseudotsuga menziesii</i>
<i>Abies lasiocarpa/Vaccinium</i>	C	C		(S)	S	(S)	
<i>Abies lasiocarpa/Carex</i>	C	C	A	(S)	S	(S)	A
<i>Populus tremuloides/Carex</i>	A	A	A	C	A	A	
<i>Pinus ponderosa/Carex</i>			C	A	A	A	
<i>Pinus flexilis/Hesperochloa</i>	A			A	A	C	

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A vegetation classification based on concepts and methods developed by Daubenmire was used to identify five habitat types and their related phases on the Medicine Bow National Forest: *Abies lasiocarpa/Vaccinium scoparium*, including the *Pinus contorta/Carex geyeri* community; *Populus tremuloides/Carex geyeri*; *Pinus ponderosa/Carex geyeri*; and *Pinus flexilis/Carex geyeri*. A key to identify the habitat types and management implications associated with them are provided.

Keywords: Vegetation classification, *Abies lasiocarpa*, *Picea engelmannii*, *Pinus contorta*, *Pinus ponderosa*, *Pinus flexilis*, *Populus tremuloides*.

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